

ABSTRACT

An electrochemical power system including one or more fuel cells integrated on or into a substrate is described. For each fuel cell, at least two stacked layers comprising a cathode layer and an ion exchange layer are situated within the substrate. A first access path for allowing an oxidant to access the cathode layer is provided from one side of the substrate, and a second access path for allowing a fuel or a reaction medium containing a fuel to access a layer in the stack is provided from the other side of the substrate. A third access path, which may be the same or different from the second access path, allows egress of one or more reaction products from the layer. A first conductor connects to the cathode, and a second conductor connects to the second access path or the layer in the stack accessible through the second access path. A regeneration unit for regenerating fuel from one or more reaction products also can be integrated on or into the substrate. The regeneration unit comprises a reaction chamber with one or more areas of ingress and one or more areas of egress. A first flow path interconnects the one or more areas of egress of the reaction chamber with the second access path of the one or more fuel cells. A second flow path interconnects the third access path of the one or more fuel cells with the one or more areas of ingress of the reaction chamber.